20 years of molecular markers in *Musa*

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What is an ideal marker ?

- - Polymorphic
- - Codominant
- - Multiallelic
- - Neutral
- - Non epistatic (no interaction with other markers)
- - insensitive to environmental pressure
- - cheap

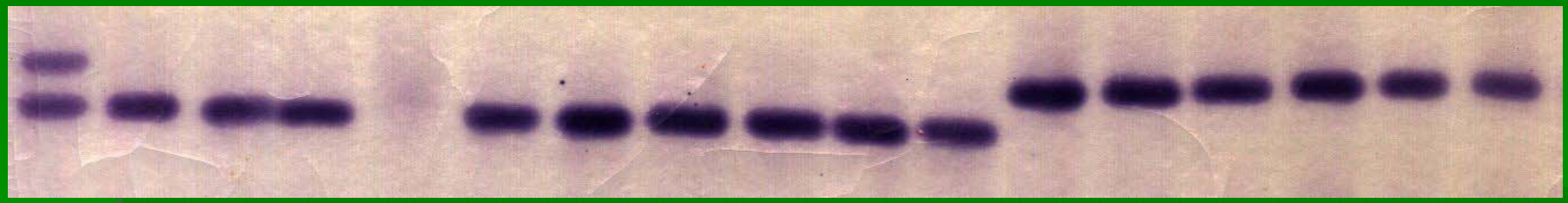
Why molecular markers ?

- Morphological markers are not very polymorphic, often dominant and selected, and very sensitive to environment (e.g. drought, diseases, mineral carency can affect colours or plant height)…
- They are however very useful
- Molecular marker are not affected by environment, and closer to the ideal type of marker but are more difficult to set-up and expensive

Overview of molecular markers in Musa

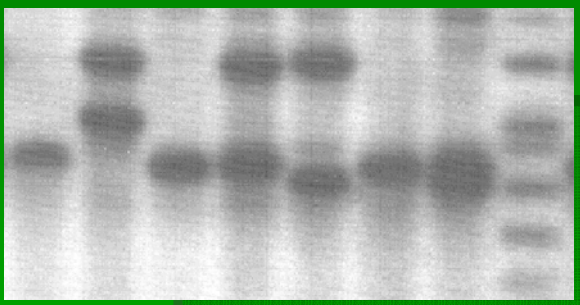
- Isozyme
- RFLP (nuclear and cytoplasmic)
- AFLP
- SSR
- DArT
- Others

Isozyms



- First molecular marker used in banana in the eighties
- Molecular classification of *Musa*, good estimation of genetic relationship within clones.

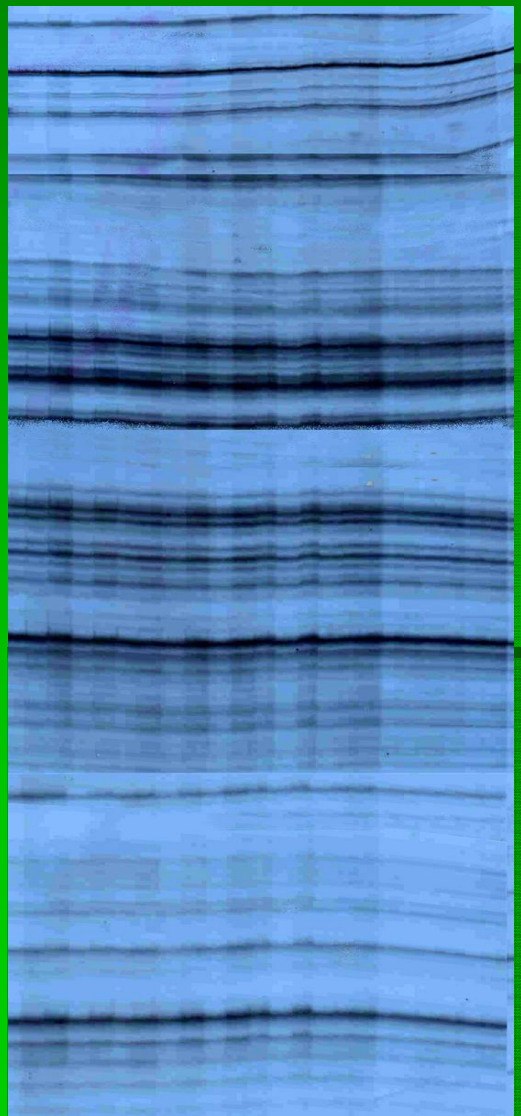
RFLP :
Restriction Fragment Length Polymorphism



- Ideal molecular marker, polymorphic, codominant, multiallelic, neutral, not affected by environment but …
- Expensive and requires complex laboratory infrastructures.
- Depending on the probe used to reveal polymorphism, each DNA of the plant can be targeted : Nuclear, Chloroplastic or Mitochondrial.

- Confirm genetic relationships initially revealed using isozymes. Better insight into genetic diversity, phylogeny and relationships between wild and cultivated plants
- First partial genetic map
- Unexpected organelle inheritance in *Musa* :
  - Chloroplast : maternally inherited
  - Mitochondria : paternally inherited

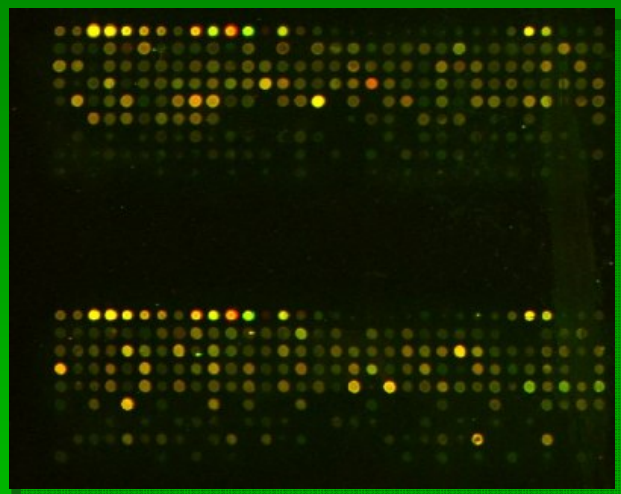
AFLP :
Amplified Fragments Length Polymorphism



- Very polymorphic, neutral, not affected by environment but …
- Requires complex laboratory infrastructures, dominant and not always "stable" amongst laboratories and sometimes plants

- Contribute to genetic maps
- Insight into closely related groups of *Musa* (Cavendish, African plantain, cultivars of the same geographical origin…)

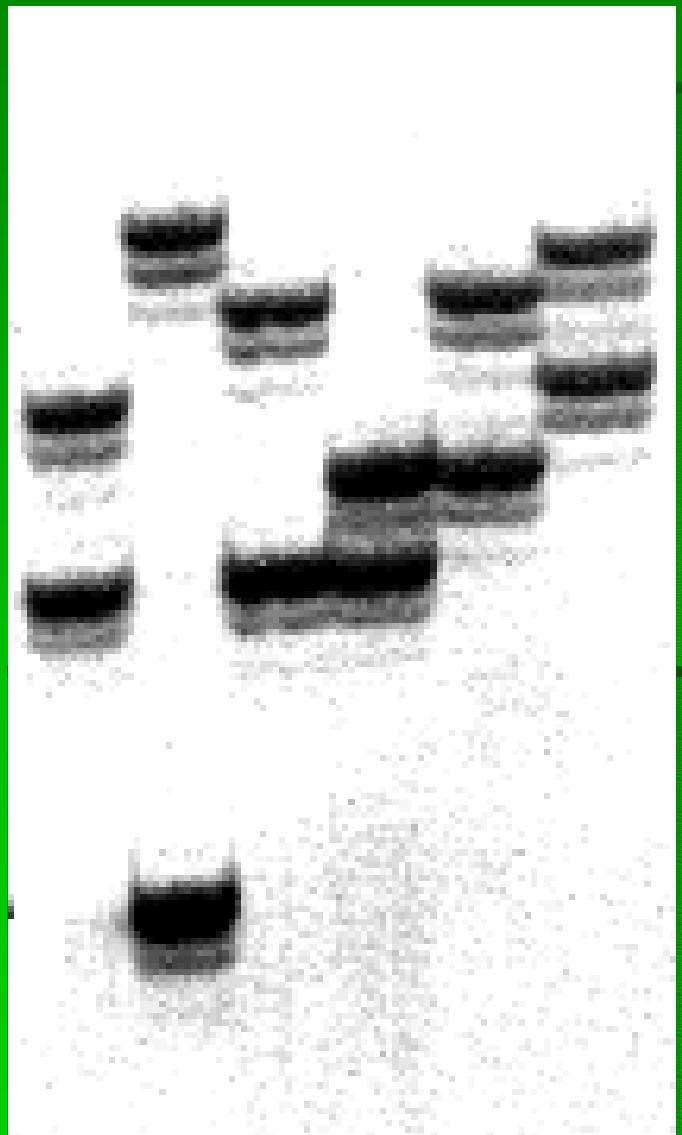
DArT :
Diversity Arrays Technology



- Reverse AFLP
- Polymorphic, high throughput, neutral, not affected by environment but …
- Requires complex laboratory infrastructures, dominant

- Technique is under investigation for use in banana…
- Allows for high throughput technology

SSR (simple Sequence Repeats) Microsatellites



- Ideal molecular marker, highly polymorphic, codominant, multiallelic, neutral, not affected by environment but …
- Expensive to develop.

- Confirm relationships between wild and cultivated bananas
- Allows for genetic studies of wild diploid species (AA or BB)
- Phylogeny of *Musa* sections
- Base of genetic map

- 10 polymorphic microsatellite loci are sufficient to distinguish almost all accessions (except in very closely related groups: Cavendish, Plantain, Pacific Plantain, Prata)
- Robust and reliable marker for checking conformity.

AND ALSO…

- SNP
- RAPD
- CAPS
- SCAR
- SSCP
- MSAP

- Thank you for your attention !